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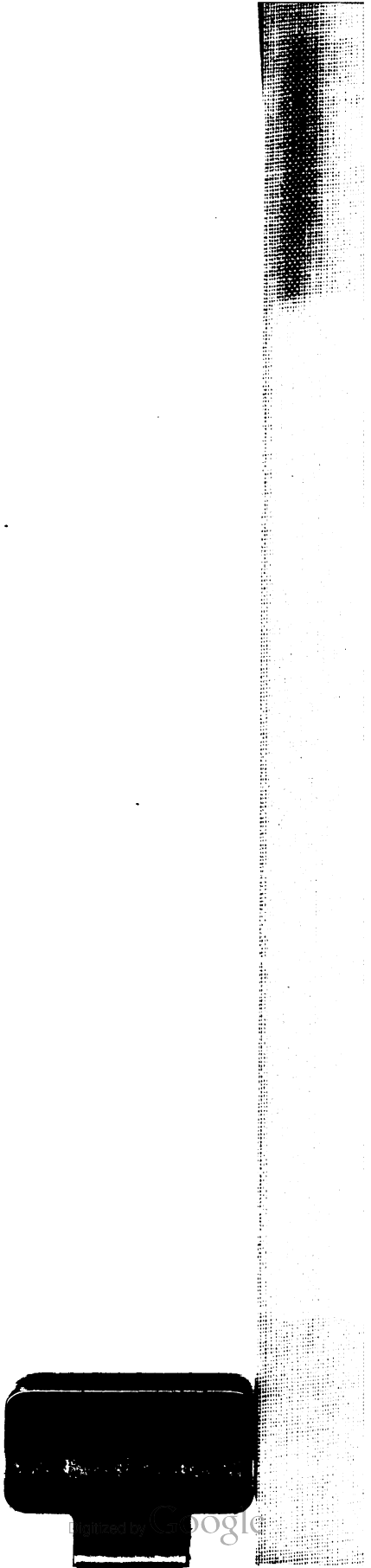
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AUGUST, 1908 BULLETIN 257

CORNELL UNIVERSITY

AGRICULTURAL EXPERIMENT STATION OF

THE COLLEGE OF AGRICULTURE

Department of Dairy Industry (Extension Work)

DEFECTS IN AMERICAN CHEDDAR CHEESE

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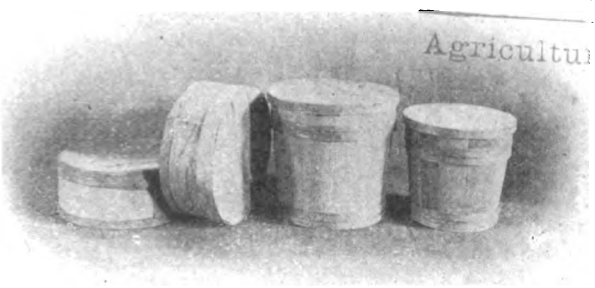

By C. A. Publow

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DEFECTS IN AMERICAN CHEDDAR CHEESE.

Causes, Remedies, and How to Prevent Them.

The purpose of this bulletin is to provide a ready reference that will aid New York manufacturers of American cheddar cheese to prevent or remedy the most common defects in their product. In order to understand and to be able intelligently to remedy or prevent defects in cheese, it is necessary to know just what the underlying causes are. If a correct diagnosis is made, then the treatment is usually easy.

I. Defects in Flavor.

A. Acid Flavors.

Indicated by a sour smell and taste.

Cause.

Over-development of acid during the manufacturing period, which is commonly due to one or more of the following:

(1) Ripening the milk too much before adding the rennet.

(2) The use of too much starter.

(3) Failure to firm the curd before removing the whey.

How to prevent.

(1) Have less acid in the milk before adding the rennet. Sour milk should not be accepted from any patron.

(2) Use less starter. Generally one-half per cent. to two per cent. is sufficient.

(3) Add the rennet early enough so that the curd will become firm in the whey before developing the desired amount of acid.

Remedy.

Refer to the treatment explained under remedy for acid texture. (Page 8.)

B. "Off" Flavors.

Flavors that are not clean. When in an advanced stage, cheese so affected are called "stinkers."

Cause.

Undesirable bacteria which gain entrance to the milk or to the curd some time during the manufacturing process, commonly due to:—

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(1) Failure of patrons to wash thoroughly and scald all cans and utensils coming in contact with the milk. This is particularly true of cans in which whey is brought from the factory.
(2) Careless milking in unclean places.
(3) Allowing the milk to become exposed after milking, in places where the air is impure.
(4) Keeping the milk at too high temperature.
(5) Using an unclean strainer either at the farm or the cheese factory.
(6) Using utensils in the factory that have not been thoroughly cleaned and scalded.
(7) Using badly flavored starters.
(8) Using impure water for diluting rennet.
(9) Soaking curd in impure water after milling. This causes lack of flavor and later on bad flavor.
(10) Using tainted rennet or salt.
(11) Ripening cheese at temperatures above 60° Fahr.

How to prevent.

By absolute cleanliness in the production and handling of the milk and throughout the whole manufacturing process.
(1) All utensils, especially the milk strainer, should be thoroughly washed with warm water and washing powder, then scalded with live steam.
(2) Milking should be done in clean places, where dust, cobwebs and flies are not found.
(3) Milk should be cooled to at least 60° and better 50° Fahr., immediately after being drawn from the cow.
(4) Tainted milk should not be taken from any patron. If uncertain of the source of tainted milk or curds, use the fermentation test on each patron's milk.
(5) By the use of clean flavored starter.
(6) Impure or bad smelling water should not be used.
(7) Screens should be on the doors and windows to prevent the entrance of flies.
(8) Curds should not be soaked in impure water after milling.

Remedy.

(1) Firm the curd a little more than usual in the whey by raising the temperature.
(2) Develop a little more acid before removing all the whey.

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(3) Mill early and expose well to fresh air by stirring for some time immediately after. Excellent results can be secured at this time because each small piece of curd has four freshly cut surfaces which permit the gases and odors to escape.

(4) Increase the amount of salt in extremely bad cases.

(5) Ripen the cheese at low temperatures.

C. Fruity Flavors.

Sweet flavors having an odor like that of ripe fruits, such as pineapple, raspberry, strawberry, etc. To the taste they are not pleasant and somewhat sickening.

Cause.

(1) Bacteria carried into the milk by dirt.

(2) Transporting both milk and whey in the same cans that have not been properly cleansed.

(3) Exposing milk to the air of hog-pens where whey is fed.

How to prevent.

(1) Cans used for delivering milk should not carry whey unless they are emptied and thoroughly cleansed immediately after arriving back from the factory.

(2) All whey should be pasteurized at the factories. This would not only greatly reduce the source of badly flavored milk, but it would eliminate the danger of transmission of tuberculosis through the whey.

(3) The whey tanks should be cleaned and scalded at least twice a week. A steel tank has the following advantages: It is more durable than wood or cement, does not leak, does not absorb the whey, is easily cleaned, and is cheaper in the long run.

(4) Use a clean flavored commercial starter.

Remedy.

(1) Firm the curds a little more in the whey by raising the temperature.

(2) Develop a little more acid.

(3) Air the curd well after milling.

(4) In extreme cases use more salt.

D. Bitter Flavors.

Indicated by a bitter taste and a "weedy" odor.

Cause.

(1) Bacteria and yeasts.

(2) Allowing cows to wade in and drink from stagnant pools.

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(3) Using rusted milk cans or utensils.
(4) Using old starters that have developed too much acid.
(5) Using milk delivered in cans in which sour whey from dirty tanks is returned.

How to prevent.

(1) Milk should be cooled to at least 60° and better to 50° Fahr. immediately after milking.
(2) Rusted cans or utensils of any kind should not carry milk.
(3) Cows should have good water only.
(4) Clean flavored starters only should be used.

Remedy.

(1) Very little acid should be developed before removing the whey.
(2) Firm the curd more than usual. Heat it higher in the whey and stir it dryer when removing the whey.
(3) Mill early and expose well to fresh air by stirring.
(4) In extreme cases use more salt.

E. Food Flavors.

Those characteristic of the foods eaten by a cow. A food flavor can be distinguished from one produced by bacteria in that a bacterial flavor usually gets worse as the milk or cheese ages, while a food flavor generally decreases with age.

Cause,

(1) Such foods as turnips, onions, leeks, weeds, garlic, rape, decayed silage and clover.
(2) Exposing milk in an atmosphere where any of these are exposed.
(3) Storing milk in cellars where decayed vegetables are present.

How to prevent.

(1) Foods that impart any objectionable flavor to milk should not be fed or made accessible to the cow.
(2) Use a good commercial starter.

Remedy.

(1) Heat the curd several degrees higher in the whey. The high temperature helps to drive off the volatile flavors.
(2) Air the curd well, especially after milling.
(3) Ripen the cheese at a low temperature.

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II. Defects in Texture and Body.

F. Dry Textures.

Cheese that are too firm, mealy, rubbery or corky.

Cause.

Lack of moisture or butter fat or both, produced by

(1) Removing part of the butter fat from the milk.
(2) Too high heating in the whey.
(3) Heating too long.
(4) Too much stirring at the time of removing the whey.
(5) Using too much salt.
(6) Curing cheese in an atmosphere that is too dry or too hot.

A "high cooked" cheese is rubbery or corky; one that has been stirred too dry is mealy or sandy; and one dry from excess of salt tastes salty. This is a convenient way of determining the cause of such defects.

How to prevent.

(1) All the milk-fat should be retained in the cheese as far as possible.
(2) The lower the temperature used for heating and still have the curd firm enough, the better will be the texture of the cheese.
(3) Be absolutely sure of the correctness of thermometers.
(4) Study the moisture content and the amount of stirring and salt required.

Remedy.

(1) Pile dry curds higher.
(2) Keep the air moist by placing hot water in the vat.
(3) Do not mill dry curds early.
(4) A dry curd can be made mellow by soaking in pure cold water after milling, but the cheese will not have a good keeping quality.
(6) Paraffine the cheese as soon as possible.
(7) Ripen the cheese in a cool room where the atmosphere contains at least eighty per cent. moisture.

G. Acid Textures.

These may be either dry or moist, but in either case they are of a mealy or sandy character. They have a sour taste.

Cause.

(1) Ripening the milk too much before adding the rennet.
(2) The development of too much acid during the manufacture especially before the whey is removed.

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(3) The great majority of acid or sour cheese are caused, not by the giving of too much acid, but by not having the curd firmed in the whey when the acid has developed.

(4) Using large starters.

How to prevent.

(1) No sour milk or milk containing more than twenty-six hundredths of one per cent acid should be taken from any patron.

(2) Add the rennet early enough so that the curd may be firmed in the whey by the time the acid has developed sufficiently.

(3) Do not use too much starter.

4) Keep the development of acid under control by controlling the moisture.

Remedy.

When it is absolutely necessary to make sour milk into cheese it should be done in the following manner:

(1) Heat the milk not above 80° Fahr.

(2) Use an extra amount of rennet.

(3) Cut the curd into smaller pieces.

(4) Heat higher. The degree of heat will depend on the rapidity with which the acid is developing. Most fast working curds contract rapidly so the heating can be hurried.

(5) As soon as possible after heating the whey should be run down to the level of the curd. This greatly facilitates stirring and firming of the curd, and if more than one vat is being used, time is saved when the remainder of the whey is to be removed. If by this time the curd is not firm and shows too much acid, a sour cheese can be prevented by,

(6) Removing the whey and putting on pure water at a temperature of 102° Fahr. The amount of water used and the time it is left on will depend on the amount of acid in the curd. In extreme cases it may be necessary to use a second quantity of water. As soon as the curd becomes firmed in the water and the acid reduced to a normal amount, the water should be removed. The curd should then be treated like an ordinary sweet one. This method is not to be confounded with the "soaked curd" process, which is different.

(7) If after milling curds are sour, they can be improved by a washing in pure water at 80° Fahr. This resembles the

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"soaked curd" process and as a rule the cheese have not a good keeping quality. However, it is much better than allowing the cheese to sour, and should be used in extreme cases.

Use an extra amount of salt after washing.

H. Loose or Open Texture.

Also called soft or weak bodied. These cheese are very soft and full of holes. Such defects are noticed more when found in export cheese, as for that trade a close boring cheese is demanded.

Cause.

(1) Developing too little acid and retaining too much moisture.
(2) Putting curd to press at too high a temperature.
(3) Lack of pressing.
(4) Soaking curd in water after milling.

How to prevent.

(1) Have at least .24 per cent. acid in whey running from the curd after it is piled for cheddaring.
(2) The curd should be cooled to at least 80° Fahr. before pressing. This can be hastened by running cold water around the outside of the vat lining.
(3) Two days pressing is much better than one. A continuous pressure is of more value than a short heavy pressure.
(4) Curd should not be soaked in water.

Remedy.

(1) Open cheese can be closed up considerably by repressing.
(2) Ripen in a cool atmosphere.

I. Yeasty Cheese.

Indicated in the green cheese by small white pin holes which later enlarge into fish-eye-like slits. The flavor is usually bitter. Colored cheese when affected usually become mottled. A bitter flavor can usually be detected in the milk and curd. The curd may exhibit peculiar characteristics. It is usually difficult to firm in the whey. The acid appears to develop slowly at first, but very fast from the time the whey is started till it is all removed. After milling the curd will become "mushy" if it is at all moist, and the whey running from the curd may show less acid than it did before milling. The curd is usually very

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slow to shrink up before salting. In extreme cases the whey tank may boil as though heated by fire.

Cause.

(1) Yeasts. These enter the milk on hay dust and from leaves of trees. They grow and multiply most rapidly when milk is kept at temperatures above 60° Fahr.

(2) Returning sour or unpasteurized whey in milk cans aggravates the trouble.

How to prevent.

(1) Milk should be kept free from dust, and should be cooled to at least 60° Fahr. as soon as milked.

(2) Use a clean commercial starter.

(3) The whey should be pasteurized and the tanks cleaned every day.

(4) If the trouble is already present, the whey tank, all factory utensils and all patrons' milk cans and utensils should be thoroughly cleaned and scalded.

Remedy.

(1) Add the rennet early.

(2) Heat curd in the whey a few degrees higher.

(3) Draw off the whey with as little acid as is practical, but have the curd well firmed first.

(4) Do not pile the curd high unless gas is present.

(5) If gas is present, more acid must be developed at dipping, but the curd should be stirred dryer.

(6) After milling, if the curd tends to become mushy, one-half the salt should be applied. When the curd is well shrunken, apply the other half.

J. Gassy Cheese.

Indicated by the presence of pin-holes. They usually have a bad flavor, are spongy, and the curd may float on the whey in the early stage of manufacture.

Cause.

(1) Gassy milk produced by bacteria which are carried in by dirt.

(2) Gassy starters.

How to prevent.

(1) Gassy milk should not be accepted from any patron.

(2) Gassy starters should not be used.

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Remedy.

(1) If it is known that the milk is gassy, use a safe amount of clean commercial starter.
(2) Ripen the milk a trifle more before adding the rennet.
(3) After cutting, stir the curd till whey around it shows at least .15 per cent. acid before heating.
(4) Heat slowly. Take from thirty minutes to one hour.
(5) Care should be taken to not have the curd too firm in the whey before the acid starts. An acidimeter is a valuable guide at this time.
(6) A little more acid should be allowed to develop before removing the whey. About .32 per cent. after the whey is all off is sufficient.
(7) Should the curd float, remove enough whey to bring the curd to the bottom of the vat.
(8) Pile gassy curds before and after milling.
(9) After milling, the curd should be thoroughly stirred and aired before piling. The pressure causes the small pieces to become very thin. After the piling and airing have been repeated a few times at intervals of fifteen to twenty minutes, the gases should have nearly all escaped. The pin-holes will then have become flattened and present a "dead" appearance.
(10) The whey running from the curd at this time should show 1.2 per cent acid.
(11) Cool curd well before hooping.
(12) Press for two days if possible.
(13) Ripen in a cool place.

K. Greasy Texture.

Indicated by free butter located in mechanical holes in the cheese. The cheese surfaces are usually greasy. This condition is most common in the spring time.

Cause.

(1) Allowing milk to become too old before manufacturing. In factories that do not take milk on Sunday the trouble is always greatest on Monday.
(2) Heating milk too high or too long before adding rennet.
(3) Handling curd too roughly.
(4) Piling curd too much.
(5) Maturing curd at high temperature.

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(6) Using a mill that bruises the curd.
(7) Ripening cheese in hot curing rooms.

How to prevent.

(1) Make up the milk daily.
(2) Cut and stir the curd very carefully while soft.
(3) Do not pile curd more than two layers deep.
(4) Do not heat milk or curd too high. Be sure of thermometers.
(5) Use a mill that cuts the curd without squeezing the fat from it. The knives should move against the curd and not the curd against the knives.
(6) Apply the salt soon after milling and mature curd in the salt.
(7) Ripen cheese in a cool room.

Remedy.

(1) Rinse the curd with pure water at 90° Fahr. before salting. Then use a trifle more salt.
(2) Cool curd before hooping.
(3) Use large clean press cloths to insure a good rind formation.
(4) Use sufficient hot water at time of dressing the cheese.

III. Defects in Color.

L. Pale or Acid Cut Color.

This term explains itself.

Cause.

(1) The development of too much acid which bleaches or cuts the color from the curd.
(2) Failure to firm the curd early enough in the whey.
(3) Using large starters.
(4) Using poor color.

How to prevent.

(1) Have the curd firmed in the whey before the acid has developed to more than eighteen one-hundredths of one per cent.
(2) Cheese should be colored to suit the market for which they are intended.

Remedy.

(1) The best place and time to produce a bright even color in the curd is while the whey is being removed. From the time the whey has reached the level of the curd till it is all removed, the curd should be well stirred. The color can be seen to develop rapidly during this handling,

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(2) Allow the curd to stand sometime after salting before hooping.

M. Mottled Color.

An uneven color, most noticeable in colored cheese.

Cause.

(1) An uneven development of acid and moisture in the curd.
(2) Uneven cutting, leading to an uneven contraction of the curd when heated in the whey.
(3) Neglecting to strain the starter when lumpy.
(4) Adding starter after color.
(5) Uneven piling and maturing of curds.
(6) Use of poor color.
(7) Mixing curds from different vats.
(8) Lumpy conditions of the curd at time of removing the whey or when salt is applied.
(9) Adding old curd.
(10) Yeasts. When due to these the mottling increases with the age of the cheese.

How to prevent.

(1) By uniform cutting, heating and stirring. This is facilitated by the use of a five-sixteenth inch perpendicular wire knife, and a five-eighths inch horizontal steel knife.
(2) Each particle of curd should be kept separated from the others while being heated.
(3) Starter should always be strained.
(4) Starter should be added before the color.
(5) Curds from different vats should not be mixed.
(6) Old curd should be placed in the vat about fifteen minutes before the whey is removed.

Remedy.

When curds are badly mottled there is no remedy that will make the color uniform. In some instances the color will become more even as the cheese ages.

N. Seamy Color.

A condition in which the outline of each piece of curd can be easily seen in the cheese. The uniting surfaces are marked by a pale line.

Cause.

(1) Greasy curds, which prevent an even absorption of salt.
(2) Impure salt.

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How to prevent.

(1) If curds are very greasy they should be rinsed off with pure water at 90° Fahr. just before salting.

(2) Only high grade salt should be used.

Remedy.

Prevention.

O. Rusty Spots.

Red spots resembling rust, and located usually where two pieces of curd have pressed together.

Most noticeable in white cheese.

Cause.

(1) *Bacillus rudensis*, which gains entrance to the milk or curd.

(2) Unsanitary buildings and surroundings. When whey leaks through the factory floor, the red material formed by these bacteria may develop. It may then be carried into the factory by wind or flies. Once in the factory every utensil used in the manufacturing soon becomes infected and the trouble increases.

How to prevent.

(1) Keep everything used in the factory absolutely clean.

(2) Do not allow the factory floor to leak. Cement floors are most sanitary.

(3) Keep the drain and drain pipes clean.

(4) Use screen doors and windows during fly time.

Remedy.

(1) The only way to get rid of this trouble is by a thorough cleaning and disinfecting of the factory surroundings and all utensils.

(2) The starter, if one is used, should be renewed.

How to clean and disinfect.

(1) Wash all utensils with a brush, hot water, and washing powder, and put them into the large milk vat.

(2) Put a cover over the vat and turn live steam into it.

(3) Steam the utensils for at least one-half hour.

(4) If the drains are dirty, clean them with hot water and washing powder. Then steam them for at least twenty minutes.

(5) If the ground surrounding or under the factory is infected, have it covered with lime or fresh earth.

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(6) The inside walls, cheese shelves and all wood work should be washed with a hot solution of bichlorid of mercury. This is made by dissolving seven and one-half grains of bichlorid of mercury in one pint of water. Apply this solution with a brush or broom, as *it is a poison.*

IV. Defects in Finish.

Anything that detracts from the appearance of a cheese is a defect As a rule it is a defect due to carelessness on the part of the maker.

P. Unclean Surfaces.

Cause.

(1) Placing cheese on unclean or moulded shelves in the curing room.

(2) Using dirty hoops or handling the cheese with dirty hands.

How to prevent.

(1) Wash the shelves after each shipment of cheese leaves the factory. Use a brush, hot water, and some good washing powder that will remove grease Place them in the sunlight to dry.

(2) Cheese hoops should be clean. So should the hands of the maker.

Q. Cracked Rinds.

Openings in the side or ends of the cheese. They are unsightly and allow the entrance of moulds, flies, etc.

Cause.

(1) Too much acid.
(2) Greasy curds.
(3) Use of hard press cloths.
(4) Lack of pressing.
(5) Wrinkled bandages.
(6) Too dry an atmosphere in curing room.

How to prevent.

(1) Avoid excess acid. (See remedy for acid texture, p. 8.)
(2) Rinse greasy curds with water at 90° Fahr. before salting.
(3) Press cloths can be softened by soaking in a weak solution of sulphuric acid.
(4) Press cheese longer before dressing.
(5) Curing room atmosphere should register eighty per cent. moisture.

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Remedy.

(1) Repress the cheese. If this fails,

(2) Paraffine the cheese.

R. Mouldy Surfaces.

The formation may be of several colors.

Cause.

The growth of moulds is due to

(1) Too much moisture in the air.

(2) Atmosphere too warm.

(3) Not enough circulation of air.

(4) Lack of cleanliness in curing room.

How to prevent.

(1) Curing rooms should be so equipped that the temperature and moisture can be controlled.

(2) Good circulation of air should be provided.

(3) Curing room should be kept clean.

Remedy.

(1) By spraying cheese with ten per cent. formalin.

(2) By burning sulfur, three pounds to one thousand cubic feet of air.

(3) By washing the ceilings, walls, shelves and all wood-work with a hot solution of bichlorid of mercury (*poisonous*) made by dissolving seven and one-half grains in a pint of water, and then washing with clear water.

(4) By whitewashing the walls and ceilings.

V. Facts a Cheesemaker Should Remember.

The finished cheese can be no better than the milk from which it is made.

Every cheesemaker should be familiar with the use of the acidimeter and the fermentation test.

The cheese factory should be a centre of rural dairy education.

The maker should be qualified to teach his patrons.

If the factory building is neatly painted, if the surroundings are tidy, and if the maker himself has a good appearance, it will be easier to induce the patrons to furnish better milk.

It will be of much greater value to both the cheesemaker, the patron and the consumer, if in the future more attention is given to the improvement of quality rather than quantity.

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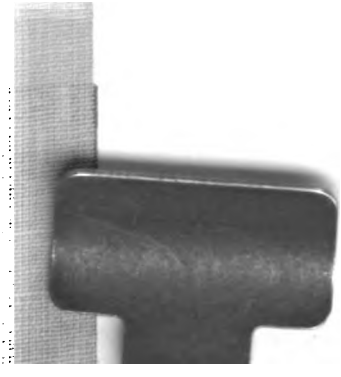

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